Ecosystem Restoration in the Long Tom River Basin for Water Quality Improvement in the Willamette River

Preliminary Findings

Prepared by
Long Tom Watershed Council
Dana Erickson, Cindy Thieman

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City of Eugene

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- **Landowners** in the Long Tom River basin.

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Introduction

The goal of this project was to produce materials that support the City's TMDL options assessment, under compilation through March of 2008. This report gives some preliminary answers with regard to project types and priority areas when considering ecosystem restoration activities in the Long Tom Watershed as a method to accomplish water quality improvement in the Willamette River. Specific detail is provided with regard to shading the Long Tom River to achieve temperature reduction. Areas of potential further investigation are noted throughout the report and summarized in Appendix B.

Background

In the Willamette Basin, there is considerable movement toward creating markets for ecosystem services. Multiple complementary investigations are occurring and technical and system experts are addressing each of the components necessary to create a marketplace for the trade of many types of credits. Chief among them are water quality credits.

> *Demand for water quality credits to meet Clean Water Act standards is driven by newly established Total Maximum Daily Loads in Oregon for water quality parameters such as temperature, dissolved oxygen, bacteria, and more. In general, the analysis suggests that all the major point sources in the Upper Willamette reach (upstream of river mile 108) have excess thermal loads that exceed waste load allocations and thus may have an interest in acquiring thermal credits. (Willamette Partnership, 2008)*

One example of this is a municipality like the City of Eugene needing to offset the thermal loading from treated wastewater discharges to the Willamette River. A typical solution to reducing the thermal impact would be to build a large cooling plant. However, the simplest version of another option would be to pay landowners in surrounding watersheds to plant trees to produce shading over the longer term that cool streams. This alternative approach invests in natural systems and, coupled with a high quality organizational framework to identify, value and track investment as well as return, and a sound technical approach, it has great potential.

This project explores the potential for ecosystem restoration in the Long Tom River basin to improve water quality in the Willamette River. The primary emphasis was assessing potential reduction from solar loading by implementing riparian shading, and landowner interest in participating in this activity in a marketplace framework. The Long Tom River was chosen because it is the most underperforming for shade in the Willamette Basin. The difference between current and potential effective shade levels is 32%[1]

[1] Figure 1.48 in the TMDL appendix reports the McKenzie River in sections at 14.2% and 32.8% respectively for the lower and upper river. The 32.8% number, which would be slightly higher than the Long Tom River, is an artifact of calculation (Ryan Michie, DEQ, pers. comm.).

(ODEQ, 2006, p.C-139). Based on long-term average flows, the Long Tom River contributes on average 5.5% of the flow of the average Willamette River at Albany (A. Donner, USACE, pers. comm.). Modeling suggests that shading the entire lower section of the Long Tom River, from Fern Ridge Reservoir down to the southern confluence at Norwood Island, could reduce the temperature of the river as much as 4° C. Therefore, there is significant thermal load reduction potential along the lower Long Tom River.

Priority Area Determination

To gain the maximum Willamette River temperature reductions from Long Tom Watershed restoration projects, it is recommended that restoration activities be focused in the lower Long Tom, Bear and Ferguson Creek sub-watersheds. (The map in Appendix A delineates the ten sub-watersheds in the Long Tom Basin.) The primary reason for this is the influence of Fern Ridge Reservoir. Fern Ridge is very large and shallow, which leads to long hydraulic residence time. Any temperature reductions gained from restoration projects upstream of Fern Ridge would be negated once the water entered the reservoir (Stuart Rounds, USGS, pers. comm.).

Another advantage of restoration in this priority area, particularly on the Long Tom River downstream of Monroe, is improving winter rearing habitat for juvenile Spring Chinook and fluvial cutthroat trout that migrate between the Long Tom and Willamette Rivers (Gary Galovich, ODFW, pers. comm.). Also, Bear and Ferguson Creek have the highest *E. coli* concentrations in the rural portion of the Long Tom Watershed (Thieman, 2007). Thus, projects that increased shade and excluded livestock from streams in these sub-watersheds would achieve both stream temperature and bacteria reduction requirements.

In late summer, Ferguson and Bear Creek contribute approximately 4 and 6 cfs, respectively, to the lower Long Tom River. From early June through mid to late September, 7-day average maximum daily temperatures in Bear Creek are above the state standard of 17.8° C, ranging from 20° – 23° C. Ferguson Creek temperatures are somewhat cooler and drop down again earlier, with maximum daily temperatures ranging from 18° – 22° C from early July to early September (Long Tom Watershed Council, unpublished flow & temperature data). If temperatures in both these streams could be reduced to meet the state standard of 17.8° C, this could cool the lower Long Tom by as much as 0.5° C.[2] Developing a Shadealator model or other method for identifying high

[2] "Back of the envelope" calculation shown below is for the lower Long Tom and Bear Creek at typical late summer flows and temperature, with the exception that Bear Creek is assumed to be 17.8° C for the purpose of estimating its temperature impact on the lower Long Tom if Bear Creek were to meet the state temperature standard.

Formula

(QLTa * TempLTa) + (QBC * TempBC)/ (QLTa + QBC) = Temp LTb

Where, Q= flow, Temp= water temperature, BC= Bear Cr., LTa= Lower Long Tom above Bear Cr., LTb= Lower Long Tom below Bear Cr.

Calculation

(74 cfs * 22° C)+(5.8 cfs * 17.8° C)/(74 cfs +5.8 cfs)= 21.7° C

priority shading areas for Bear and Ferguson Creek would be an important step in developing shade credits within these sub-watersheds.

Although not a priority sub-watershed for reducing temperatures in the Willamette River, Coyote Creek is also underperforming for shade; current effective shade is 22.8% less than system potential. With relation to the Ecosystem Marketplace, there is discussion that any restoration activity above the "point of maximum impact" on the Willamette River would count for credit, regardless of its location. If this is the case, Coyote Creek might also be considered a priority area for developing shade credits with multiple benefits in the Long Tom Watershed. With respect to achieving multiple benefits this is an important addition as Coyote Creek is a high priority sub-watershed for restoration due to the extensive amount of natural habitat remaining.

Restoration project types for temperature mitigation and other benefits

Riparian Planting

Increasing shade through riparian planting has been shown both in practice (Derek Godwin, OSU Extension, unpublished data and Cindy Ricks-Meyers, S. Coast WS Council, unpublished data) and theory to significantly reduce stream temperature and increase dissolved oxygen. On cropland, enhancement of riparian areas also has the potential to reduce nutrient and sediment contributions to local rivers and streams (see: www.deq.state.mi.us/documents/deq-swq-nps-gw.pdf, www.extension.iastate.edu/Publications/PM1507.pdf)

Instream Impoundment Removal

A promising mechanism to improve stream temperature and dissolved oxygen is removal of certain instream impoundments. The Long Tom River's impoundments consist of three check dams installed to control grade on the channel. One of the dams is also elevated in the summer by the Junction City Water Control District to provide irrigation water to adjacent farms. Smaller impoundments are scattered across the Ferguson, Bear and Coyote Creek sub-watersheds. These typically have been put in for irrigation or aesthetic purposes. Temperature monitoring data at an impoundment on Jordan Creek, a tributary of the Coyote Creek sub-watershed, suggest that some impoundments significantly raise stream temperature. This impoundment slows stream velocity and creates a broad shallow pool behind it. Coupled with no shade, this has led to a significant temperature impact. In this instance, maximum daily water temperatures were as much as 8° C higher immediately downstream of the impoundment (Thieman, 2007). It would be worthwhile to investigate other impoundments located on the valley floor that have no shade and create wide shallow pools to see if this temperature influence is seen elsewhere.

Connection to cool water sources

Connecting streams to cool water sources, such as springs, might also create cooling. Evaluating this potential would require research into specific project methodology in addition to an evaluation of sub-surface flow patterns in the Long Tom Watershed. Other possible sources of cold water augmentation are existing impoundments in the headwaters of Bear, Ferguson, and Coyote Creek. Many are on private forestland and maintained for fire safety. These may contrast to impoundments on the valley floor in their width to depth ratio and existing shade. If these impoundments are stratified, it is possible that cool water could be pulled from the bottom, much like summertime reservoir releases are regulated in the Cascades[3]. This would require temperature profile monitoring and an evaluation of technical feasibility to determine if this is a viable option.

Related to both removing impoundments and connecting to cool water sources, the Long Tom Watershed Council (LTWC) is conducting a Fish Barrier Assessment in 2008. This project will identify and map instream impoundments in selected sub-watersheds. Temperature monitoring of some of these impoundments may be possible.

Floodplain restoration and hydrologic reconnection

Improving river-floodplain interaction, via levee removal or setback, bank terracing, and historic channel reconnection, provides a number of potential environmental benefits. Levee removal or setback would increase off-channel and instream habitat, reduce erosion, and increase floodplain storage. Stream terracing increases off-channel habitat during high flows and, similar to levee setbacks and historic channel reconnection, promotes sediment deposition by creating areas of slower velocity. Historic channel reconnection would also improve stream habitat and reduce erosion, and in some locations may reduce stream temperatures if increased shading and groundwater interaction occurred.

Hyporheic flow occurs where coarse gravel dominated soils exist along a river. Hulse *et al*. (2007) have identified many such locations along the Willamette River where floodplain restoration could have significant temperature benefits. Investigations into the temperature impact of hyporheic flow are ongoing (Lancaster et al., 2005; Willamette Partnership, 2008). Many of these locations are adjacent to the Long Tom Watershed and are within LTWC's extended service area on the west side of the Willamette River. Decreasing stream temperatures by increasing hyporheic flow is not likely along the lower portions of the Long Tom, Bear, or Ferguson Creek, because this type of flow does not occur in the tight, clay soils found on the valley floor in the Long Tom Watershed.

Multiple Benefits from Shading

Where riparian shading is being used to reduce stream temperatures, other water quality benefits may also be realized. For example, one could prioritize riparian planting for

[3] In some of these situations it is a higher ecological priority to remove them for fish passage.

sites where erosion is a problem. If the soil contains mercury, arsenic, or other toxics, this action will also reduce the mobilization of these pollutants into the waterway. Another way to achieve multiple benefits is to add management actions on the site where riparian planting is occurring, such as fencing to exclude livestock to reduce *E. coli* and bank erosion. Riparian planting projects that are combined with levee removal, historic channel reconnection, and bank sloping or terracing can add multiple water quality and habitat benefits. **Table 1** summarizes the potential benefits realized by each project type.

Table. 1 Summary of Restoration Actions & Benefits

Project Type	**Benefit**
Riparian planting	Decreased stream temperature; increased dissolved oxygen; increased bank stability, which leads to decreased turbidity/suspended solids & delivery of soil bound pollutants, such as mercury, to stream; increased habitat for riparian dependent species such as song birds and amphibians
Fencing for livestock exclusion/control	Increased bank stability, which leads to decreased turbidity/suspended solids & delivery of soil bound pollutants, such as mercury, to stream; decreased delivery of livestock waste to stream, which leads to reduction in bacteria and nutrient pollution
Small dam removal	Decreased stream temperature; increased dissolved oxygen; improved fish passage; restoration of normal sediment transport regime
Floodplain and hydrologic reconnection (Levee removal, historic channel reconnection, bank terracing)	Decreased stream temperature; increased dissolved oxygen; increased floodplain storage; increased off-channel and instream habitat and complexity; restoration of hydrologic regime; decreased bed and stream bank erosion
Cold water augmentation	Decreased stream temperature; increased dissolved oxygen

Implementation timelines for different project types

The specific stages to consider when estimating implementation timelines are site selection, outreach, contract development, funding, permitting, implementation, maintenance, benefit realization, monitoring and reporting. Pre-implementation stages are subject to many unknowns such that only the implementation period timelines are presented in **Tables 2 and 3**. Implementation timelines could also be affected by the total number of projects in an area. For example, if a large number of restoration sites become available at the same time, the availability of plant material and contractors may slow the process until sufficient capacity is developed to meet the demand. On the other hand, implementing many similar projects within a close time frame could make those projects collectively more efficient in competing for and utilizing contractor and staff attention.

Table 2. Project Implementation Timelines and Benefits (excludes pre-implementation requirements)

Project Type	**Implementation Period**	**Benefit Realized**
Riparian planting	1 – 2 years to plant trees. 5 years full - *see Table 3*	10-15 years
Fencing for livestock exclusion/control	6 - 12 months	Immediate
Small dam removal	1-2 years	Immediate
Floodplain and hydrologic reconnection (Levee removal, historic channel reconnection, bank terracing)	1-2 years	Immediate
Cold water augmentation	1-2 years	Immediate

Table 3. Timeline for Implementing Riparian Shading Projects[4]

Year 1	Site preparation, plant materials, planting, maintenance, program operations, project management and administration
Year 2	Plant materials, inter-planting, maintenance, program operations, project management and administration
Year 3	Maintenance, monitoring, project management and administration
Year 4	Maintenance, monitoring, project management and administration
Year 5	Maintenance, monitoring, project management and administration

Viability of Project Types for TMDL Implementation Options

TMDL implementation includes BMP work on parameters that are more challenging to measure, such as bacteria, and specific targets for more measurable parameters such as temperature. For those with a quantifiable target, two steps are necessary before project types can be considered viable for offsetting TMDL requirements. First, there must be a

[4] See also Clean Water Services Thermal Credit Cost Summary 2007 (updated 1/08), attached.

formula relating a measurable unit for the project type (e.g. acres of floodplain restored) to a unit of the anticipated benefit (e.g. kCal reduction). Second, there must be a calculation of how many units of the restored feature are needed to provide the desired amount of benefit. Riparian shading is the restoration project type receiving significant attention at this time for temperature mitigation. Investigations by DEQ and other professionals in the field are providing spatially explicit information on current and potential shade, and formulas to convert shade potential into heat load reduction. In anticipation of the abovementioned formula becoming available for the Willamette Basin, LTWC conducted a survey of potential sites for riparian restoration. The methods and findings from this project are described in the following sections.

Riparian Shading of the Lower Long Tom River

Within the priority area, the lower Long Tom River from Fern Ridge Dam to the southern confluence at Norwood Island carries the most flow and therefore the greatest potential for reduced thermal load to the Willamette River. In addition, the lower Long Tom is the only sub-watershed within the priority area that has Shadealator model results.[5] The modeling results allowed LTWC to identify sections of the river that would yield the greatest temperature reductions if shaded on both sides to maximum natural or system potential (potential effective shade). Maximum natural potential for all riparian areas in the Willamette Valley was determined by a group comprised of DEQ, The Nature Conservancy, and Oregon Department of Fish & Wildlife. This group used historic vegetation information (circa 1850s) to determine appropriate plant community and structure for riparian areas in the Valley (Pamela Wright, DEQ, pers. comm.). For example, in some areas the historic riparian plant community was prairie, so maximum natural potential would not include canopy forming trees. In other locations, floodplain forest created a complete or partial canopy over streams and rivers. The latter example is the case for the historic riparian vegetation of the lower Long Tom River (Thieman, 2000).

Methods

Products from the lower Long Tom River Shadealator model include current and system potential shade, and solar load reduction potential for each 100-foot segment of the river. In addition, DEQ developed a GIS shape file with each segment represented as a colored dot indicating the relative potential to reduce solar loading through riparian shading.[6] Red indicates the greatest potential for reduction and is associated with segments that have little or no existing riparian vegetation. Green indicates the least potential reduction and is associated with well developed riparian areas.

[5] Note: In the Long Tom Watershed above Fern Ridge Reservoir, Coyote Cr. and Amazon Cr. also have Shadealator results.

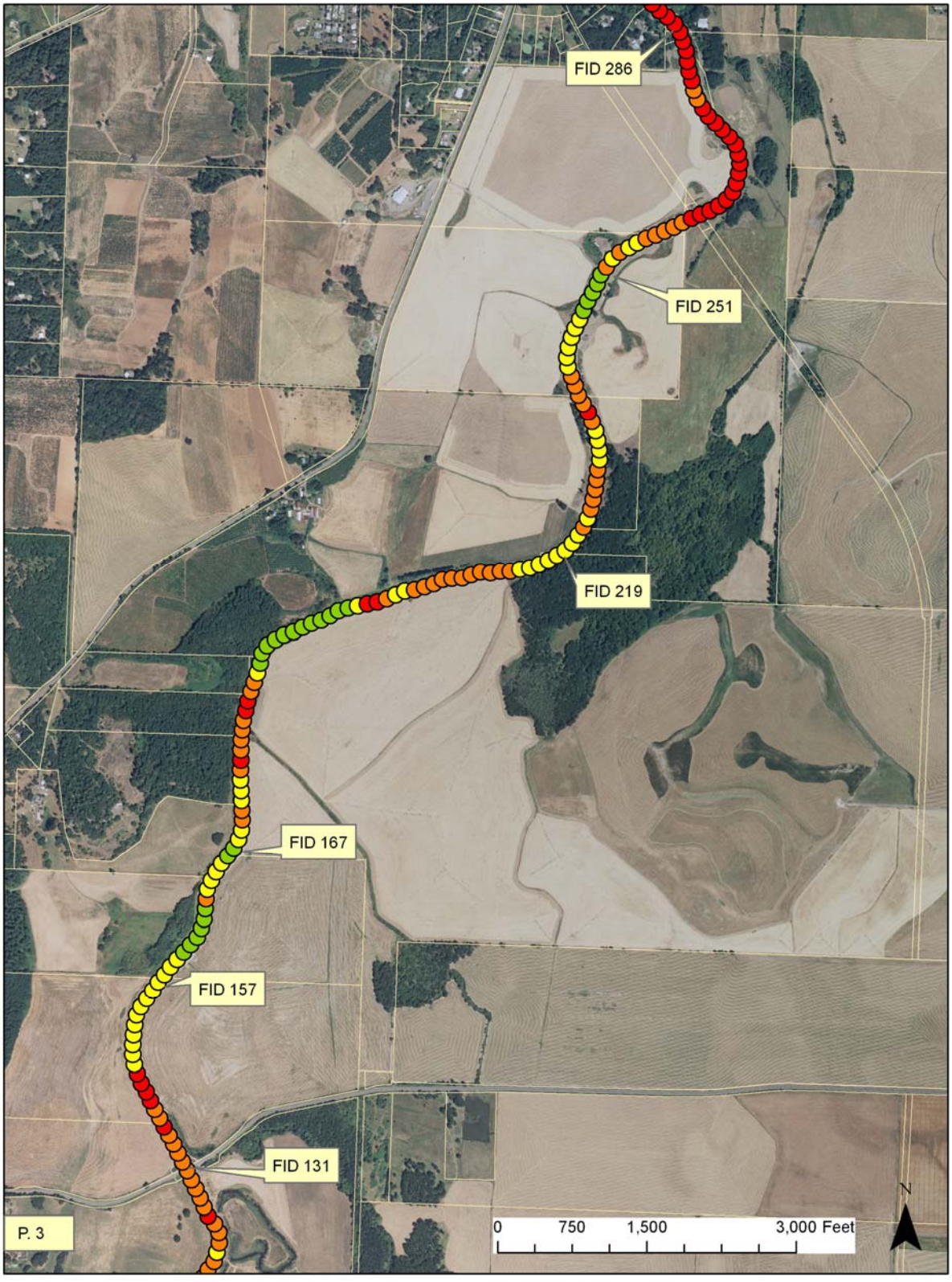
[6] This was provided by York Johnson, DEQ (see Acknowledgements for details)

Maps were created combining potential solar load reduction with land ownership and 2005 aerial photos (see **Figure 1** for a sample map). This allowed identification of relatively longer reaches having the greatest potential for reduction, as listed in Table 4. Fewer landowners per reach would likely mean fewer contracts, management and administrative costs. Thus, reaches with one or a few landowners that are relatively long (2,000 – 10,000 feet) and have high solar load reduction potential (e.g., mostly red and orange dots) would likely yield the greatest reduction per dollar invested. Table 4 displays these selected reaches and converts the reduction potential into kilocalories (kCal) per day, which is the unit currently applicable in permit and trading discussions[7].

In addition to current vegetation, the aspect, bank height, streambed substrate and wetted width of the channel segment also influence the potential effect of new shade. For example, a channel running east-west would receive the greatest benefit from maximum shade on its southern banks. Also, the lower the bank height and narrower the wetted width, the more effective shading will be. This explains some of the variation in potential reduction of solar loading for segments that appear to have similar existing riparian vegetation.

[7] Shadelator results are output in Langleys/day, which are converted to kCal/day with the following equation: Kcal/day = (Langley/day) x .001 x (surface area cm^2)

Figure 1. Sample map of Shadelator Results.
Note: Landowner names have been removed for privacy.



Findings

Potential solar load reduction ranged from approximately 17 million kCal/day for a 2,000' segment to 189 million kCal/day for a 9,600' segment (see **Table 4**). These results must be tempered with several facts. First, DEQ's Shadealator calculations are based on aerial photo interpretation calibrated with field verification at publicly accessible points along the river and as such should be considered estimates that guide the selection of potential priority areas and where outreach should occur. The calculation of actual shade credits will be based on field measurements only. Second, DEQ's model assumes that both sides of the river are shaded to their maximum natural potential. In reality, one may not be able to shade both sides if there is differing land ownership. Also, other factors, such as aspect or bank height, may indicate that shading one side may achieve a majority of the potential overall benefit. Third, maximum theoretical shade may not be practically achievable on the lower section of the Long Tom River managed by the Army Corps of Engineers because this channel is currently required to be maintained for flood control, which at this time means the planting zone extends down the stream bank but stops short of the summer water level[8].

For comparison, Clean Water Services (CWS) has found that their solar load reduction, based on field measurement calculations, ranges from 100,000 – 500,000 Kcal/day/100' segment. For a 2,000' reach segment, their aggregate amount would range from 2 million to 10 million Kcal/day compared to the 17 million Kcal/day above. Given the planting limitations on the lower Long Tom River, the range of CWS values are probably closer to what would realistically be achieved. Additional field visits and calculations are necessary steps before any final prioritization among sites occurs. If the sites were being considered for shade production in association with a credit value, a standard field form recognized by the Marketplace, would be essential.

[8] The Army Corps of Engineers is currently evaluating how to address planting projects within its flowage easement along the Long Tom River as the presence of trees and shrubs will change the way maintenance is conducted.

Table 4. Potential thermal load reductions for selected reaches on the lower Long Tom River

FID	RM S end	RM N end	Linear feet	West side landowner(s)	East side landowner(s)	Kcal/day	Kcal/day/linear ft.
48-129	22.784	21.231	8200	1	2	105,990,703	12,926
				3	4		
				5	6(BLM)		
				7			
				8			
				9			
131 - 151	21.193	20.814	2000	10	11	17,322,828	8,661
167 - 219	20.511	19.508	5300	12	11	59,673,408	11,259
				13			
				14			
				15			
251 - 286	18.902	18.239	3500	16	16	41,822,434	11,949
					17		
287-303	18.22	17.917	1600	18	19	16,340,905	10,213
				20			
				21			
371-399	16.61	16.08	2800	22	22	36,174,397	12,919
404-424	15.985	15.606	2000	23	24	19,082,643	9,541
				25	25		
448-473	15.133	14.659	2500	26	27	31,114,422	12,446
527 - 546	13.636	13.277	1900	28	29	31,651,323	16,659
				29			
547 - 573	13.258	12.746	2700	30	30	49,266,826	18,247
577 - 624	12.67	11.78	4700	28	31	78,212,724	16,641
					32		
625 - 673	11.761	10.833	4900	28	33	63,477,730	12,955
674 - 786	10.814	8.6742	11300	34	34	152,651,465	13,509
1145-1241	1.8182	0.00	9600	35	36	188,874,862	19,674
				36	37		
				38	39		
				36			

Elements of a performance monitoring plan for riparian shading and bacteria reduction

CWS monitors shade credit performance by measuring density of live shrubs/trees and shade (densitometer readings) in randomly selected plots throughout the riparian planting areas. Final survivorship densities of ≥15,25 stems/acre is considered an indicator of successful riparian restoration. CWS staff also establish photo points, estimate invasive species cover, and make general observations about the condition of the restoration area for each site. Please see the complete CWS protocol attached to this report.

In addition to the CWS implementation monitoring methods described above, LTWC recommends instream temperature monitoring at a sub-set of riparian restoration sites. Continuous temperature monitoring should occur from June 1 – October 15 immediately upstream and downstream of selected planting sites and at an appropriate number of control sites. Sites in the Bear and Ferguson sub-watersheds would be good candidates because the smaller stream sizes makes temperature probe placement and retrieval more successful, and the ability to detect temperature changes over time is more likely due to lower stream flows.

Evaluation of *E. coli* concentration reductions from livestock exclusion projects is more difficult due to the variable nature of bacteria concentrations in streams. One possible approach is to implement monthly long-term monitoring at the mouths of targeted streams within the Bear and Ferguson Creek sub-watersheds. For example, Owens and Jones Creek, within the Bear Creek sub-watershed, have several years of prior collected *E. coli* data and they have some of the highest concentrations in the Long Tom Watershed. Once projects were implemented, post-project bacteria data could be collected for 2 to 3 years and then compared to pre-project data using Seasonal Kendall and T-test statistics.

Considerations in contracting with landowners for shade production

When considering restoration of lands in private ownership, the interest and understanding of those owners is essential. Producing benefits quantified by credits for trade, banking, or sale is familiar to some people from examples of wetland banking in the region however very few have participated and know sufficient detail. The task for this project was to assess the willingness of landowners to contract and provide ecosystem services, shade in this case, and to outline the features of a contract for the sale of credits.

Methods

Relatively longer reaches with high solar load reduction potential and a single landowner (on one side) were prioritized for outreach. Ten landowners were identified and seven were successfully contacted. Six agreed to a conversation and five of these conversations happened on site. The interviews were conducted during December 2007 and January 2008 by Dana Erickson and Cindy Thieman, both staff of the Long Tom Watershed Council. Background and potential Q&A information was developed but not used as script. The questions listed below were posed. Please see Appendix C for further methods and specific answers.

Questions

1. Would you consider putting your riparian area into plantings to shade the river? Would being compensated for that "crop", such as an annual payment, increase your interest?
2. If the conditions were satisfactory would you be interested in a contract for "growing" shade for 10-20 years? [interested here in entering contract and lengths of term]
3. How might you come up with an amount for the "per acre" payment for the riparian area that piques your interest? What is an approximate range for that amount?
4. What is a "good average" net profit for the range of crops you grow?
5. Is there a base contract amount and/or length that would be important to make entering into the business relationship worthwhile?
6. Are there any potential requirements from your end to make an arrangement / business transaction worth your while?
7. How soon would you be willing to make a sale?
8. Overall, how do you view a transaction like this?
9. Do you have any concerns/ideas/questions we can think about as we work on this project, or get back to you about?

One landowner participated in contract development with a team working for Willamette Partnership. This team was comprised of specialists from David Evans and Associates and CH2MHill, Willamette Partnership, Long Tom Watershed Council staff and board member, and City of Eugene staff. The latest version of that contract available at the time of this report is included in the Attachments and some of the primary issues discussed from a landowner perspective are included with interview responses below.

Findings

All the landowners represent medium to large-scale agricultural operations in the lower Long Tom River basin, ranging from 1,000 to over 2,500 acres. All are owner-operated “family farms”. The following is a summary of the responses. For individual responses, please see the appendix. There was a certain amount of philosophizing during the discussions. Some of that may be informative in preparing for additional outreach and is also captured in the appendix.

Credit calculations

Although the buyers will be interested in their cost per kcal, it will be useful when dealing with landowners to use units that are not far removed logically from acres, and to make calculation methods transparent. It is unclear where the notion of a credit fits into this equation. There is also a concern in valuing any credits or transactions per kcal as the heat load calculations may vary. The need is strong for expressing the transaction, especially the payment and cost calculations, in units that property owners are familiar with or that are well-connected with the land and product being sold.

Contract payment amounts

Landowners differed in whether they viewed the program as a business venture or as a reasonable way to fund a beneficial project. If payment is considered, the gross payment amounts, and subsequent net profit, must compare equivalently or favorably to a crop net profit in an average year. The more complicated the overall contract or relationship the more important the balance leaning toward the favorable side will be. This is true even after acknowledging that the riparian land acreage may not otherwise be put into production mostly because the property owner would prefer the land sit ready for an unknown and perhaps larger return than tie it up for small returns. Specific payment amounts varied widely, $350 – $1,600, and would depend on whether or not the ground was in production.

Minimum Contract Value

The total contract value must be worth the up-front cost of establishing a new venture, especially as the venture is not repeatable multiple times (e.g. property owners own a finite acreage). Cost would include: time, energy, materials, effect on work crews (hours needed/activities) and compatibility with other land management activities of the seller, and perhaps other considerations. The annual payment must also reach a worthwhile minimum; the number discussed for the annual payment values seemed to fall consistently in the $1,000 – $1,500 per year range.

Uncertainty or “Hassle” factor

There will be a factor in the valuation of the transaction from the landowner’s perspective that makes it worth their while to engage in any business relationship. In the types of transactions being considered here overcoming the hassle factor will be more “costly” as the transaction becomes more complex or increases in uncertainty or includes entities with unknown or changing representatives and decision-makers (e.g. a contract including a government entity that also requires monitoring access by that entity). This may be overcome with a first contract value addition or signing bonus.

Permission to access land

This cannot be open-ended but once per year for monitoring purposes is accepted as reasonable if the entity is less known or a government entity. There are also quarterly

monitoring needs in the first 5-year period (or until the vegetation is "free-to-grow"). Third-party contracts for this, perhaps an entity or person known or otherwise trusted by both parties, would likely be seen as the most reasonable from the perspective of the contract parties and the conservation community.

Upfront payment

It is unclear how important an up-front payment will be. In the crop industry, initial payments are unusual –conversely, a significant cost outlay is required. From a project quality control perspective some parts of the upfront payment may be best tied to the most major aspect(s) of implementation production (e.g. vegetation planted).

Contract signing bonus or value addition

If contract signing bonuses were considered for an initial period when program implementation begins, there would be more incentive to participate. Conversely, there would likely be program "bugs" to work out and it may be more effective to have less participants as bugs are being worked out. A signing bonus could also be given to each property owner for their first contract. This could occur between buyer and seller, as part of or independent from the written contract.

Explaining the system

There is a finite set of agricultural landowners with property appropriate for achieving riparian establishment for shade production that affects temperature, especially when considering those that have influence over large acreages. In the agricultural community word travels fast and reputation, whether program or personal, is a critical element to any business relationship. A fair amount of outreach and marketing time could be built into the initial period of the program to show adaptive management in addressing concerns, problems, sense of fairness, and new opportunities. That outreach could be conducted by buyers, marketplace representatives, or some other agent.

Landowner Involvement in BMP activity [9]

Landowner involvement interest ranges from installing the BMP to conducting the routine maintenance. In this sample, only one landowner was interested in the installing the planting. Most others would consider conducting the maintenance. Where the landowners was interested in conducting the maintenance it was because they are accustomed to being involved in all aspects of running their land and operation – studying the soil and planning for crops, managing rotations, fixing machines, negotiating business.

[9] In the interviews, the planting activity was *not* referred to as a best management practice. Various interview methodologies suggest that inferring value in a question may affect the integrity of the answer so these types of references were omitted.

During installation, the quality of the planting directly affects survival. The initial cost investment for installation is relatively large and early failure creates a significant setback in production. Costs for maintenance include getting water to trees, costs to spray back competing vegetation, costs to guard against browse, and possible crews to do some of the work. Replanting should also be addressed. From a quality-control perspective, the landowners conducing the maintenance is not as risky as the initial planting.

To be determined within the contract is who installs the BMP (seller, buyer-approved party, certified party/contractor) and to be determined within the marketplace system would be who sets the criteria for that decision, or the criteria for who qualifies as an approved party. It is recommended that if the landowner wants to implement the BMP themselves, they obtain some certification. Some quality control attention to maintenance would also be beneficial, whether that be in the form of certification or maintenance criteria and reporting.

Contract Development

One council staff and one board member, who is also a landowner in the priority area, participated in the development of the Credit Exchange Agreement by the Willamette Partnership. Specific comments not incorporated in that process or referred to above are described below. In addition, Clean Water Services has developed multiple contracts that may be available as examples.

Performance Bond

Because the success in achieving the outcomes intended by the contracted arrangement are entirely dependent on the quality of initial planting and the survival of those plantings, a performance bond seems important, if not essential.

Annual Monitoring

There was willingness to see the annual payment tied to a successful monitoring report.

Protection Clauses/ Limited Liability

There is a need to have opt-out or relief clauses due to circumstances beyond landowner control - e.g. beaver or blow-down. Landowners were willing to re-establish the BMP however questioned how that cost would be addressed and how many times a seller would have to replant after those occurrences. Pooled performance bonds are an option here. Questions also arose concerning transferability if land ownership were to change. There was also a potential desire to opt-out if the contract payment were to decline over multiple years as diminishing returns would not be a continued incentive. This might be balanced with the finding that all landowners in this sample except one did not see any reason to remove a riparian area once it was established. The sole reason was due to putting a crop back on valuable ground.

Floodplain Easements

An option for further investigation is site reconnaissance and landowner outreach for multiple benefit work. For floodplain restoration in particular, the management of water emerges as very important to the landowner we spoke with that was familiar with the work of Hulse and Gregory referenced in this report. Although he said he would be open to a floodplain lease, removing water rapidly was essential to avoid crop damage. Specific discussions would enable the evaluation of these opportunities for achieving or maximizing the ecological benefit from flooding.

Project Relationship to Marketplace Activities

Credit Calculations

The first "draft" credit calculator under development for the Willamette Partnership was not available to us before the preparation of this report. Field-testing this for results is an area of further investigation.

Watershed Council Roles

It is not clear at this time what role, if any, the Long Tom Watershed Council would play in the Ecosystem Marketplace. Options include: outreach to landowners about the marketplace as a restoration funding mechanism, brokering for landowners if they request that assistance in selling credits, aggregating certain landowner-sellers and offering credits for sale on their behalf, field-verifying credits offered for sale, implementing restoration work, stewarding implemented projects, monitoring and reporting on implemented projects. LTWC may elect one, multiple, none, or varying roles in the future. LTWC recognizes that some roles may be mutually exclusive.

For watershed councils considering involvement in the marketplace, the key is to relate the activity to the council's mission and goals, and to make sure the activities chosen fit with the work patterns and skills of the council. For example, assisting a landowner in bringing credits to sale could be compared with obtaining a restoration grant for project work on a landowner's property. Aggregating sellers could be compared with multi-landowner restoration projects that are grant funded. Much as a grant proposal is prepared, where projects components are assigned costs for the grantor and match from the landowner, a sale could be prepared that reflects the same costs and willingness of the landowner(s) to participate materially in the work. Another role that watershed councils may be well suited for is field-verifying credits as the orientation is quality-control and this fits well with the public-service and conservation focus of most councils, as well as their non-profit structure. The role of implementing restoration work is also well-suited however if the nature of the work is straightforward and repetitive it is perhaps better delivered by professional crews. The related tasks of stewarding, monitoring and reporting are another excellent role for councils for two reasons. First, these activities involve ongoing contact with landowners and thus the opportunity to discuss ongoing learning and other project potentials. Second, monitoring and reporting could build on

and relate to councils' monitoring of watershed conditions and whether or not projects are achieving stated objectives.

Conclusions

Producing cooler temperatures in the Willamette River through restoration actions on its major tributaries is not only possible, many sites would likely provide multiple benefits. The priority area for restoration in the Long Tom Watershed is the lower Long Tom River below Fern Ridge Reservoir as well as Ferguson Creek, Bear Creek and perhaps Coyote Creek. Priority project types would include riparian shading, removing instream impoundments, connecting to cool water sources, and floodplain restoration and hydrologic reconnection. Multiple benefits would be achievable in many cases; this would be determined on a site specific basis and result from the inherent properties of the site or by adding project types.

The most feasible actions to implement rapidly from an outreach, technical and credit-equation standpoint are riparian shading projects. However, if all project types had the same on-the-ground start date, the solar load reduction resulting from shading would take longer to produce than the thermal load reduction or cooling from most other project types.

The Long Tom River has the most flow in the priority area and it is estimated that shading its entire length below the dam would contribute 4° C cooler water to the Willamette. According to the Shadelator and Heat Source modeling, 17 million kilocalories of thermal reduction could be gained per 2,000 feet in the reaches with higher potential, although based on experience with shade production by Clean Waters Services in the Tualatin Basin we estimate numbers at half that amount to be more realistic. Performance monitoring should include BMP implementation (e.g. survivorship) and shade production (e.g. densitometer) as well as consequences for the targeted parameter (e.g. instream temperature). The quality of projects would need to be insured somehow; quality control is critical in attaining a high percentage success in shade production especially. Follow-through in monitoring is essential in meeting temperature reduction objectives, and those of other parameters, as is applying adaptive management or reprioritization as needed.

Landowners in high priority areas were found to be willing to contract for shade production. All understood the broader concepts of trading and the marketplace. Some saw the contracts as a business relationship only; others as continuing conservation/restoration that's the "right thing to do". At least one was interested in discussing floodplain easements. Answers were given to questions regarding duration and value of contracts, involvement and responsibilities around planting and maintenance, and their concerns and ideas regarding uncertainty and risk. LTWC roles in facilitating trades or participating in the marketplace are not set at this time and many possibilities exist for all watershed councils and their partners.

If the goal is to produce thermal cooling in part through restoration on private lands, and if it is agreed that in the future it is likely that many other benefits – bacteria, carbon, etc. – would be gained from restoration action on private lands, then there is merit to building participation in this marketplace system from private land owners as soon as possible, regardless of what project types it leads to. At the same time, caution might be best taken in terms of initial contracts for these exchanges, allowing for some subtle but important elements in landowner philosophy toward restoration and land stewardship, the public dollars being used and the public benefits provided. Care would also need to be taken with project types that are less straightforward by incorporating adaptive management principles, to maintain the credibility of matching actions on private lands to offsetting pollution sources.

Considering that the need for ecosystem restoration – water quality and habitat for fish and wildlife – currently and historically outstrips the funding available for the projects that achieve it, the possibility of a marketplace system is promising. The fact that funds from polluting impacts would be injected back into the very ecosystems under stress from the impacts appeals to common sense and would satisfy practitioners and the public alike if the methodologies were shown to be technically sound.

Finally, it should be noted that investing in restoration and conservation in a large watershed area surrounding a key river, e.g. the tributaries of the Willamette River, versus large single projects on the key river proper that would produce cooling directly at the specific measured point, may contribute more significantly to building long-term ecosystem resilience.

References

Hulse, David W., Allan Branscomb, Chris Enright, Stanley V. Gregory, Randy Wildman. 2007. Linking cold-water refuges into a biologically effective network in the southern Willamette River floodplain: outlining key locations and knowledge gaps. Unpublished report. *Note: This report available at* willamettepartnership.org/publications/MarketplacePubs/

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Thieman, Cindy. 2000. Long Tom Watershed Assessment. Oregon: Long Tom Watershed Council.

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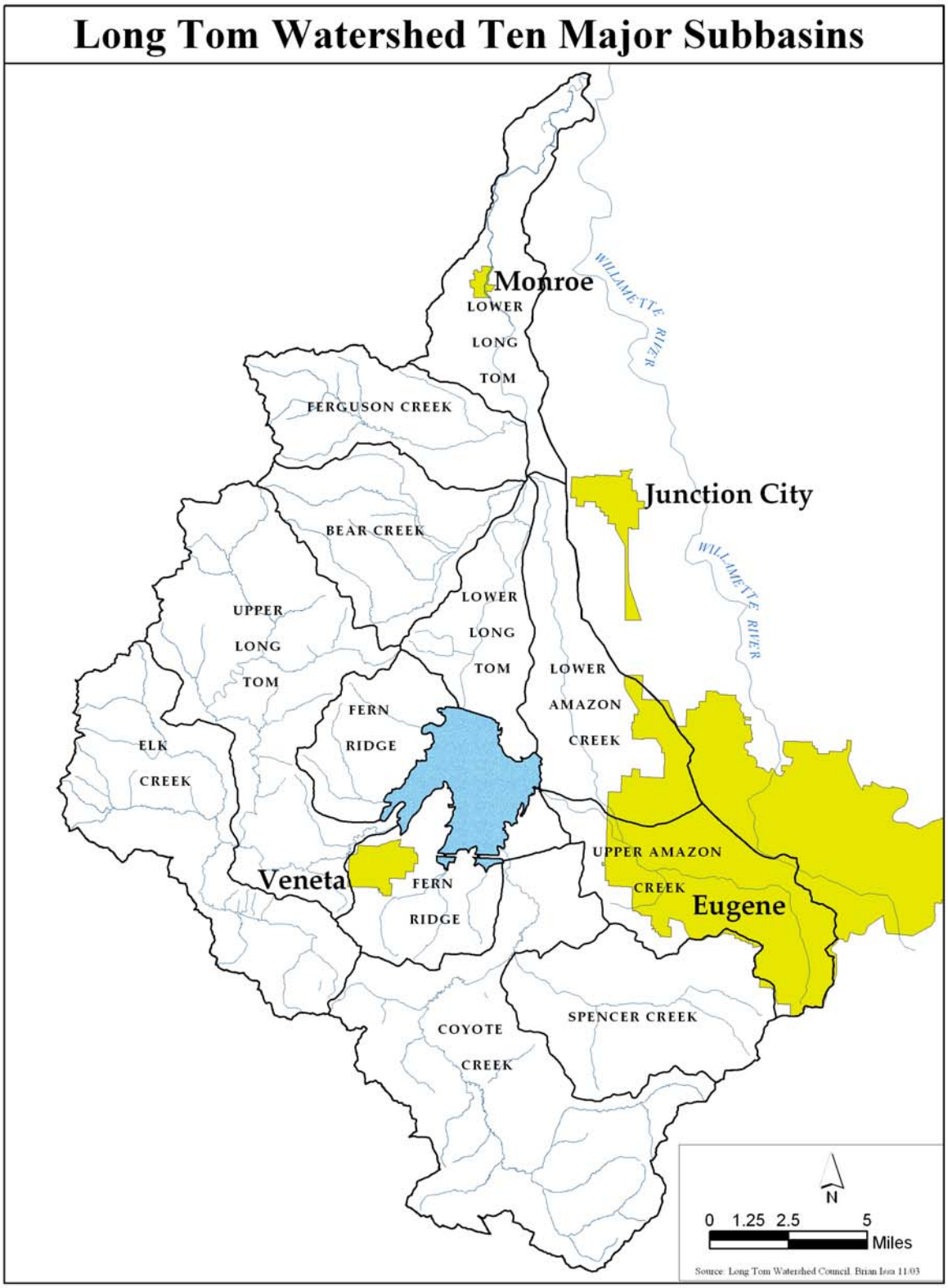
Appendices

A. Long Tom Watershed Sub-basins
B. Areas for further investigation
C. Outreach to landowners

Appendix A: Long Tom Watershed Sub-basins



Appendix B: Areas for further investigation

In no particular order, the following additional research or outreach work could be undertaken by the Long Tom Watershed Council or other entities.

- Investigate potential for cooling in Bear and Ferguson Creek by collecting field data to run the Shadelator and Heat Source models, and analyzing the results.
- Investigate potential for cooling in Coyote Creek by analyzing Shadelator results.
- Monitor temperature of instream impoundments to determine the heat load impact of ponded water. Also create temperature profile of water column in deeper ponds to determine if potential cool water sources exist in lower strata.
- Estimate the "real credit value" from a package of projects using newly released credit calculator (included as Attachment) and field work with landowners willing to contract for shade production.
- Determine potential and create priority area maps for other project types: floodplain/wetland restoration, channel reconnection, reconnection of cool water sources, impoundment removal.
    - For the latter two, use data resulting from 2008 Fish Barrier Assessment to display and describe areas where instream impoundments exist in priority sub-watersheds (most likely Ferguson and Bear Creek).
    - Additional options are to conduct landowner outreach regarding these project types, and/or to conduct research on this topic in terms of implementation, utility and effect, and how results could be confidently measured/credited.
    - For connection to cool water sources, research sub-surface flow patterns.
- Site reconnaissance for multiple-benefit work in priority watersheds.
- Continue outreach and survey work with Long Tom River landowners regarding trading. Develop program materials for other entities.
    - Alternative: Develop materials and conduct outreach with Willamette Partnership or other partners.
- Implementation and Fund-leveraging Mechanisms: Describe programs that could be used to leverage or add to credit dollars in achieving restoration for shade. Additionally or alternatively, design local version of CWS' ECREP with local SWCDs as they are willing and capable. Work with locally-active land trusts and/or SWCD to address need for easements where this is a gap.

Appendix C: Outreach to Landowners

Phone script

We would like to talk with large landowners on the Long Tom that would be interested in receiving a rental payment for growing shad trees along the river. We're working with a team to explore the potential for setting this system up. Would you have time for me to come out and show you some maps that estimate potential shade, explain more and see what you think?

Background Preparation regarding marketplace and trading

Background

In the Willamette Basin, there is some movement around creating markets for "ecosystem services". One example of this is a municipality like the City of Eugene needing to offset the thermal loading from treated wastewater discharges into the Willamette River. The standard solution is to build a large cooling plant. An option being considered is to pay landowners in surrounding watersheds to plant trees to cool the streams with shading over the longer term. Planting riparian areas could have many other benefits such as providing habitat, and buffering bacteria and nutrients from streams. A transaction where the City could "buy" this service from surrounding landowners would take place in an "ecosystem marketplace". The service would be valued and sold in terms of "credits". Credits would be calculated based on area planted and certain aspects of the site.

For our Council this type of project fits with our mission of improving water quality and riparian habitat with voluntary means and local action. LTWC roles in the marketplace might include assisting landowners in preparing/offering credits for sale, doing the restoration (tree planting), verifying aspects of the sale transaction in the field, or monitoring the health of the plantings and production of credits over time.

Right now we're in the exploratory stage of this project. We are participating in discussions with the lead entity (the Willamette Partnership) so that if a marketplace is developed it is realistic and works for the people that we work with. We also want to make sure that the restoration is well-done, that the objectives of water quality are met over time, and that the marketplace doesn't create disincentives for conservation or set it back (although that may happen temporarily).

[Could start below and give background in response to questions]

We'd [also] like to know how interested people in this watershed would be in participating in an ecosystem marketplace. Landowners would be able to restore riparian areas and sell the credits for the shade potential they produce. This potential can be calculated for every stretch of stream, although there is no approved formula yet. [Show photo and how sample calculations work]

What's involved is planting an area, watering/replanting until establishment is successful, maintaining the plantings, and monitoring. That's the standard procedure for riparian restoration. To sell the shade potential generated, there would be a contract, a verification procedure, and monitoring visits over time arranged with the seller.

Potential Q&A Topics

Who are the parties involved?

The parties involved would likely vary. In the basic scenario the landowner would offer the credits directly to the Buyer by showing the calculation for the amount of credits with a map and/ or aerial photo, a planting and monitoring plan. A Planting Contractor would be chosen (Council? Independent? Landowner?*). A Monitoring Entity would be identified (Council? Independent?). A Verifier would come and ensure the credit offering was "good," likely with a site visit (Council? Independent?). A contract would be drawn to address payments, responsibility, and liability. The transaction would be registered with the Marketplace Registry**. A Certifier (DEQ) would make sure any regulatory concerns had been properly addressed.

*There may be some kind of certification required for planting contractors.

**The registry may be the pathway to offer the credits for sale initially.

A few variations:

Landowners may not want to work directly with buyers. They could use a broker. The Council might choose to assist in this role much the same way as we assist in writing restoration grant applications for landowners' projects and providing the technical assistance, permitting, reporting, restoration and monitoring work, etc.

Large buyers (e.g. a City, or the combined cities in Metro Wastewater) need large volumes of credits and may not want to work directly with that many landowners. They may look for credits that are coming from brokers or aggregators. Landowners could use brokers, or perhaps choose to aggregate their credits into a larger offering from a group of landowners. The details of this idea are at least one step removed from the first transactions and would probably involve creativity on behalf of the sellers once the marketplace is up and running.

Timing of process

The development of this Marketplace system was being accelerated due to the need of some large cities and corporations to meet specific heat load reduction requirements in the Willamette.

The DEQ just relaxed the timeline to meet those requirements from immediately to a 5-10 year window. Some entities are still planning to use the marketplace option much sooner because there would have to be a significant number of credits in place to meet the requirements in 5 years. So the development of possible riparian projects is still very much a current effort.

Landowner responses

Questions

1. Would you consider putting your riparian area into plantings to shade the river? Would being compensated for that "crop", such as an annual payment, increase your interest?
2. If the conditions were satisfactory would you be interested in a contract for "growing" shade for 10-20 years? [interested here in entering contract and lengths of term]
3. How might you come up with an amount for the "per acre" payment for the riparian area that piques your interest? What is an approximate range for that amount?
4. What is a "good average" net profit for the range of crops you grow?
5. Is there a base contract amount and/or length that would be important to make entering into the business relationship worthwhile?
6. Are there any potential requirements from your end to make an arrangement / business transaction worth your while?
7. How soon would you be willing to make a sale?
8. Overall, how do you view a transaction like this?
9. Do you have any concerns/ideas/questions we can think about as we work on this project, or get back to you about?

Responses

UT

1. Interested? Yes. Hassle factor bonus and initial signing bonus would help willingness to enter relationship.
2. Contract? Yes.
3. Payment? Going rate. $350/acre plus costs.
4. Amount? $350-450/acre
5. Base amount and length? 10 years with extension option. $1,500 minimum.
6. Requirements? No public access. Pump sites maintained (access and erosion-prevention).
7. How soon? Anytime is fine.
8. Overall? Would be interested in doing plantings, performing maintenance.
9. Other?

TH

1. Interested? As long as trees don't compromise bank stability. Evaluation of erosion for a planting reach – make sure toe of slope is stable. Species selection matters. Reed canarygrass a concern.
2. Contract? See response for #5.
3. Payment? Would do it "for free" – agrees with goal of water trempaerature reduction and improved bank stability.
4. Amount? N/A
5. Base amount and length? 10 years at a time.
6. Requirements? Access to pump site

7. How soon? Right away would be possible.
8. Overall? "City" might be getting off easy; perhaps better to deal with problem at source.
9. Other? None. Discussed issues regarding adjacent conservation area owned by state park.

SE

1. Interested? Yes.
2. Contract? Yes.
3. Payment? Yes. Not sure how this would be calculated.
4. Amount? N/A for ranching/grazing
5. Base amount and length? $1,000 minimum. 10-15 years.
6. Requirements? Someone else in charge of tree establishment and maintenance. No public access. Can't interfere with adjacent farming activities. Would need to include fencing to exclude livestock along portions of the riparian area (no access to river necessary for livestock).
7. How soon? No time restriction.
8. Overall? Would approach it from a business standpoint, not an altruistic perspective.
9. Other? None. Attractive that part of the maintenance contract may include weed control in the riparian area as this is a nuisance.

CB

1. Interested? Open to planting but most of his frontage is already forested – the part that's not is heavily rip-rapped.
2. Contract? See response for #5.
3. Payment?
4. Amount?
5. Base amount and length? $1,000 would be worth it.
6. Requirements? No public access. Plantings would need to be on river side of access "road".
7. How soon?
8. Overall? Likes riparian vegetation (prefers that ACE not remove willow on his stretch.)
9. Other? High erosion on outside bends in this area.

HC

1. Interested? Yes, would consider it.
2. Contract? See response for #5.
3. Payment? Not essential. (This seemed polite deference instead of a real answer)
4. Amount? Whatever going rate is. Without knowing this he said $50-$100/acre rental payment.
5. Base amount and length? $1,500 minimum would probably be about right. 20 years would be a good contract length.
6. Requirements? Someone else would need to establish trees and control weeds. Contractor needs to contact landowners before going out. No public access. Can't interfere with farming operation in anyway, but doesn't expect it would.

7. How soon?
8. Overall?
9. Other?

FI

1. Interested? Would consider it. Won't give up food production.
2. Contract? Preferred, yes. No problem contracting with government entity. What if it's blown out. Would need assurances or limited liability.
3. Payment? Depends on crop and varies. Range net profit on grass: $600-700, vegetables: $500-$600, wheat: $1600 today but current high-end of market projection is $2500
4. Amount? Would have to compare to potential value of tying the land up.
5. Base amount and length? $1,500 per year.
6. Requirements? No public access. Need pump sites. Someone else do the planting. Aggregating landowners/sites seems a good idea. Species would need to be selected that would not create problems in the field, e.g. no cottonwoods. Ash, maple, pine, cedar are fine. Alder is ok.
7. How soon? Anytime. If taking crop out it would require delay for end of rotation.
8. Overall? Interested in floodplain leases although expect tight water management. It's a bitter pill to deal with water quality and riparian requirements/issues. The marketplace idea/compensation would take some of the bite out of it.
9. Other? Erosion is a problem in some places. Can that be addressed?

Further Discussion of Landowner Interest and Willingness in Credit/Shade Production

Property owner Philosophies

Property owner philosophies regarding this kind of effort will vary tremendously. For some, questions will come up that can be addressed by giving perspective for the effort, and framing it within a system. For example, the notion of a natural system of cooling water and keeping it cool appealed to a sense of reasonableness and common sense. Then there are specific philosophies, for example, some property owners will consider any connection with a government entity a "deal-killer". Some will resist being part of any "program".

Where dilemmas occur between values, the common sense aspects of using a natural system to offset pollution seems to carry the most weight. Outreach and marketing, or the "sale" of the program to the property owner/seller, needs to include working answers to the philosophical questions.

Fairness

<u>Productive Land and Public Dollars</u>

In the Agricultural community there is a strong set of ideas about how productive land should be used, and a related set of strong ideas about how each operation/farm is making its living. In the case of public dollars being used for

program implementation and allocation, there will be judgments made by some on the people that accept those funds.

There are competing principles held by different people, and sometimes the same people (e.g. land needs to be used in productive agriculture, land needs to pay its fair share of taxes - contrasted with – landowners should be able to do what they want with their land). With this mentality a person using his land for a for-profit dumping ground would be accepted whereas a person selling his as an easement or accepting government funds for conservation/restoration activity is not acceptable. This also conflicts with the values most in the rural community hold in terms of stewardship of the land for the next generation.

Urban-Rural issues

There is a struggle with the idea that an urban center pollutes excessively and the rural properties have to make up the difference. When compensated, this is more palatable from a "fair-share" perspective, and perhaps also because, practically it helps to conserve rural areas, but there is still a strong set of ideas in the agricultural communities around "doing the right thing". One working answer to this that is useful in outreach (or sales moments), is to outline the continuing work by each urban center to reduce their pollution and behavior, even as they also pay to offset the results of it.

Conservation

In keeping with the concern about doing the right thing by the land, and the reputation of the program's effect in the community (both local geographical community and larger agricultural community), there is a strong need to provide compensation for existing conservation. One idea is an annual payment for riparian areas conserved, and DEQ credit for that given to also meet permit conditions (perhaps a certain percentage of credits/kcals have to be and can be met by this). Another idea is a riparian tax credit, or OWEB funding. The important component may be the link to actions recognized by DEQ. In this example, if a polluter is required to address temperature, and the river increases in temperature, from any cause, the updated TMDL will increase the allocation of units to each entity. Since preventative action in this case might be a tragedy of the commons case, perhaps the conservation credits have an added bonus of reducing a future load allocation, and/or applying additional credits to meet that load allocation if it comes to pass.

This is not necessarily the responsibility of the marketplace system but it is in its zone of influence. The marketplace could match its rules (e.g. no contracts granted on riparian areas that have lost significant vegetation in the preceding 5 years, or since year 2006) to whatever incentives exist (e.g. grant-funded and private-funded conservation easements) for the desired conservation status to achieve a sense of fairness. Alternatively, the marketplace implementers/dependents/proponents could evaluate the limitations to the marketplace system if those other systems do not function well.

List of Attachments

The following attachments were provided with the hardcopy and CD of this report.

- 10 8.5” x 11” Maps of Shadelator Results
- Clean Water Services Monitoring Protocol
- Clean Water Services Thermal Credit Cost Summary 2007 (updated 1/08)
- *Draft* Contracts for Credit Exchange and Credit Registration (not produced by LTWC, consult Willamette Partnership)
- *Draft* Map of Willamette streams that Shadelator results are available for, courtesy Pamela Wright, DEQ
- CD only: *Draft* Credit Calculator (not produced by LTWC, consult Willamette Partnership)
- CD only: Excel spreadsheet - Summary Shadealator Results, Current and Potential Solar Load per 100-foot segment (DEQ)
- 2’ x 3’ contiguous map of Shadelator results (not included in CD)